PATENT APPLICATION

IN THE U.S. PATENT AND TRADEMARK OFFICE

Appellants:	Fei MAO and Terrance CALLAHAN
Application No.:	10/071,240
Art Unit:	2625
Filed:	February 11, 2002
Examiner:	Aaron W. Carter
For:	METHOD AND SYSTEM FOR RECOGNIZING AND SELECTING A REGION OF INTERESTS IN AN IMAGE
Attorney Docket No.:	23390-000101/US

APPELLANTS' BRIEF ON APPEAL UNDER 37 C.F.R. §41.37

April 26, 2006

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MAIL STOP APPEAL BRIEF - PATENTS

Sir:

In accordance with the provisions of 37 C.F.R. §41.37, Appellants submit the following:

I. REAL PARTY IN INTEREST:

The real party in interest in this appeal is Cedara Software Corp. Assignment of the application was submitted to the U.S. Patent and Trademark Office and recorded on at Reel 14909, Frame 0243.

II. RELATED APPEALS AND INTERFERENCES:

There are no known appeals or interferences that will affect, be directly affected by, or have a bearing on the Board's decision in this Appeal.

III. STATUS OF CLAIMS:

Claims 1-2, 4-8, 10-12, 14-15, 18, 20-24 and 26-35 are pending in the application, with claims 1, 13 and 28 being written in independent form.

Claims 30-35 stand rejected under 35 U.S.C. § 112, second paragraph.

Claims 1, 2, 4-6, 15, 18, 20, 21 and 27-35 stand rejected under 35 U.S.C. § 102b as being anticipated by U.S. Patent No. 5,903,664 to Hartley.

Claims 14 and 26 stand rejected under 35 U.S.C. § 103 as being unpatentable over Hartley.

Claims 7, 8, 10-12 and 22-24 would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

Claims 1-2, 4-8, 10-12, 14-15, 18, 20-24 and 26-35 are being appealed.

IV. STATUS OF AMENDMENTS:

The Reply After Final filed September 27, 2005 has not been entered.

V. SUMMARY OF CLAIMED SUBJECT MATTER:

The claimed invention is directed to a system and method for recognizing and selecting a region of interest in a three-dimensional image.

Referring to FIG. 1 there is illustrated a block diagram of a computer system 22 for analyzing computer-generated three dimensional images in accordance with an embodiment of the invention. As shown in FIG. 1, the computer 22 is connected to a display 24 (for example, a 640 by 480 screen), an input device 30 such as a manually operated mouse 30, and an ultrasound image data source 32 such as an ultrasound system that acquires ultrasound image data.[1]

When scanning a patient, an ultrasound operator passes a probe over a portion of the patient's body. The probe emits and receives a series of ultrasonic waves. The probes generate, say, 150 frames of data in a typical pass over the scanned portion of the patient's body. Each frame of data represents a cross-section of the part of the patient's body that is scanned using ultrasonic waves. Each frame is typically 640 by 480 pixels, but only a portion of the frame corresponding to the area of interest, which is typically about 250 by 250 pixels, is stored. Accordingly, the image data in the ultrasound image data source 32 for a single image would consist of about 150 frames, each frame being about 250 by 250 pixels.[2]

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[1] See page 6, paragraph 23.
[2] See pages 6-7, paragraph 24.

The image data source 32 communicates with the computer 22 and provides image data to a data submodule 28 of the imaging software (not represented in the block diagram of FIG. 1) on the computer 22. The data submodule 28 orders the image data in an image data array, such that each ordered image property in the image data array has associated spatial coordinates. The x and y spatial coordinates are determined by the location of the data within the 250 by 250 frame, while the z spatial coordinate is assigned to the data by the data submodule 28 based on the frame in which the data is found.[3]

In order to form three dimensional images based on the ultrasound data for image data received from the ultrasound image data source 32, the computer 22 includes a conventional polytope submodule 34 for generating a coordinate space. Preferably, the coordinate space takes the form of a right-angled parallelepiped, which will be referred to as modelPoly (where "poly" is an abbreviation of "polyhedron"). The modelPoly is defined around the origin of a left-handed xyz coordinate system.[4]

The polytope submodule 34 handles the geometry involved in rotating, translating and scaling modelPoly. The geometry involved in rotating, translating and scaling modelPoly is recorded in a rotation matrix R, a translation matrix T and a scaling matrix S, while modelPoly itself remains located about the origin. ModelPoly is rotated, translated and

[3] See page 7, paragraph 25.
[4] See page 7, paragraph 26.

scaled by the matrices R, T and S to form a winpoly. It is winPoly as projected on the screen of the display 24 that the user sees.[5]

Fig. 3 illustrates a three-dimensional rendering of an image such as shown on the display 24. The rendered volume view 42 in FIG. 3 is typically partially obfuscated by unwanted artifacts. In the case of medical imaging, these unwanted artifacts may include tissues or features unrelated to the feature of interest. The example image shown in FIG. 3 is from a fetal ultrasound scan. The volume view 42 shows a view of the face 50 and part of the torso 52 of a fetus that is partially obscured by the uterus lining 54. The position of the uterus lining 54 above the face 50 of the fetus is seen in the sectional views 46 and 48.[6]

In accordance with a method of the present invention, the user selects a point within the feature of interest using the input device 30. The system 22 determines the spatial coordinates in modelPoly corresponding to the display coordinates selected by the user. The selected point is a seed point for region growing.[7]

Referring again to FIG. 1, the computer system 22 includes a region growing submodule 36. The region growing submodule 36 is responsive to the input device 30 and maintains a growth matrix G containing the selected region. The growth matrix G is used to update a scalpelling matrix

[5] See pages 7-8, paragraph 27.
[6] See page 11, paragraph 35.
[7] See page 12, paragraph 38.

C, which the polytope submodule 34 uses as a mask for modelPoly to select the region of interest for display. The region growing submodule 36 implements a region growing routine that grows a three dimensional region in the image starting from the seed point.[8]

Simple region growing begins with a seed point in an image. From the seed point, the region growing routine analyzes each pixel surrounding the seed point and determines whether each pixel is a member of the region. The object of region growing is to select a region within an image based upon homogeneity criteria; thus, the region growing routine determines whether each surrounding pixel is a part of the region based the homogeneity criteria. The homogeneity criteria may specify that a pixel belongs to the region if the gray value of the pixel falls within a range of gray values which is based upon the gray value of the seed point. The range used depends upon the specific type of image being analyzed.[9]

After a first iteration, the region growing routine will have determined whether or not the pixels immediately surrounding the seed point are members of the region or not. The next iteration and each subsequent iteration performs the same analysis for the pixels immediately adjacent the region identified in the previous iteration. Accordingly, the region expands outwards with each iteration until the routine determines that none of the surrounding pixels are members of the region. At each pixel along the edge

[8] See pages 11-12, paragraph 35.
[9] See page 12, paragraph 39.

of the region where the adjacent non-member pixels do not satisfy the homogeneity criteria, the region growing routine may be said to have reached a threshold.[10]

In conventional image processing, region growing is performed automatically by the region growing routine until the region reaches a threshold in all directions. A disadvantage of this method of segmentation is that the region may grow into unwanted areas if the pixels or voxels between the areas and the region of interest do not present a threshold. Accordingly, reliance on a threshold (homogeneity criteria) to stop the region growing tends to result in selection of unwanted areas due to leakage of the region.[11]

The present invention provides for direct user control over the extent of the region growing through the input device 30. By manipulating the input device 30, such as a mouse or trackball, the user can control the number of iterations that the region growing routine performs. The physical displacement of the mouse or track ball is identified by the user interface submodule 40 and is used to increase or decrease an iteration variable. The region growing submodule 36 uses the iteration variable to control the number of iterations that the region growing routine performs. Accordingly, beginning from a physical starting point, the user initiates the region growing by moving the mouse or trackball. The movement is detected by

[10] See pages 12-13, paragraph 40.
[11] See page 13, paragraph 42.

the user interface submodule 40, which causes a corresponding increase in the iteration variable. In response to the increased iteration variable, the region growing submodule 36 causes the region growing routine to perform a further iteration, thereby increasing the size of the selected region. By ceasing to move the mouse or trackball, the user may stop the region growing routine even before the selected region reaches a threshold at each boundary point. Moreover, by withdrawing of the mouse or trackball towards its starting point, the iteration variable is decreased, causing the selected region to be retracted to a smaller region. Advantageously, direct user control in conjunction with a display of the growing region allows the user to prevent leakage of the selected region into unwanted artifacts.[12]

In one embodiment, the initial position of the mouse or other input device is recorded by the system 22 when the seed point is selected. Subsequently, the user interface submodule 40 detects movement of the mouse and assesses the direction in which the mouse has been moved as compared to its initial position. The user interface submodule 40 provides data to the region growing submodule 36, the data including whether the mouse has been moved and in what direction. In one embodiment, movement of the mouse to the right or left is indicative of a user instruction to expand or contract the region, respectively. Accordingly, the detection of mouse movement to the right causes the region growing submodule 36 to

[12] See pages 13-14, paragraph 43.

expand of the region by one or more iterations of the region growing routine, and mouse movement to the left causes the region growing submodule 36 to retract the region by one or more iterations of the region growing routine.[13]

The growth matrix G and the scalpelling matrix C have a one-to-one correspondence with the modelPoly coordinate space and initially contain null values. Once the user selects a seed point and that seed point is translated to a point in the modelPoly coordinate space, a corresponding point in the growth matrix G is set to 1. As the region grows in the coordinate space in a pattern based upon the image property data contained in modelPoly, the corresponding points in the growth matrix G are set to 1. The scalpelling matrix C is updated at each iteration by the growth matrix G, such that the scalpelling matrix C also contains a logical one at each coordinate system point identified as a member of the region and a logical zero at every other point. During the user-controlled region growing routine, the scalpelling matrix C is used as a mask to black out the points in modelPoly selected as members of the region. The user may monitor the growth of the region by observing the growth of the blacked-out region on the display 24. Following the termination of the region growing routine, the scalpelling matrix C is used as a mask to select only the points

[13] See page 14, paragraph 44.

in modelPoly that are members of the region. The selected region of the image is then displayed to the user.[14]

Reference is next made to FIG. 4, which shows a screen shot of the graphical interface 40 including a mouse pointer 56 located near the center of the x-y sectional view 46. The user has selected a seed point at the position of the mouse pointer 56 shown in FIG. 4. A small dark region 58 is visible about the seed point, indicating that the mouse (not shown) has been moved a small distance causing a small growth in the region 58. Each dark pixel in the small dark region 58 is a pixel that has been blacked out because the corresponding point in the coordinate space has been identified as a member of the selected region. [15]

Reference is next made to FIG. 5, which shows a screen shot of the graphical interface 40 after further growth of the selected region. The dark area 58 indicating points selected as members of the region has grown larger in response to further physical movement of the mouse (not shown) by the user. The dark area is now visible in each of the three sectional views 44, 46 and 48, allowing the user to monitor the growth of the selected region in each plane. In FIG. 6, the dark area 58 has expanded beyond the fetus' face 50 indicating that the region has leaked into unwanted artifacts, as shown in each of the sectional views 44, 46 and 48. Note the asymmetric growth of the dark area 58 due to the selected region meeting a threshold at

[14] See pages 15-16, paragraph 48.
[15] See page 17, paragraph 51.

various points in the three dimensional image space. Note also, in the volume view 42, that the dark area 58 appears in the visible plane, indicating that the region has reached the edge of the image space.[16]

The user recognizes that the region growing routine has performed too many iterations thereby causing growth of the selected region beyond the feature of interest, namely the face 50 of the fetus. Accordingly, the user physically retracts the mouse, causing a decrease in the iteration variable and a corresponding retraction in the region. By physically moving the mouse, the user may adjust the iteration variable, thereby extending or retracting the region, until an optimal region is reached. The optimal region selects as much of the feature of interest as is possible without selecting a significant number of points corresponding to unwanted artifacts. FIG. 7 shows a screen shot of the graphical interface 40 with the dark area 58 approximately covering the feature of interest in each of the sectional views 44, 46 and 48 without selecting a significant portion of the unwanted artifacts.[17]

Once the user is satisfied that the region growing has resulted in an optimal region, the system 22 will perform a scalpelling operation to remove all unselected areas of the image space. This operation is performed by applying the scalpelling matrix C as a mask to modelPoly. The scalpelling matrix C is updated from the growth matrix G so that the scalpelling matrix

[16] See page 17, paragraphs 52 and 53.
[17] See pages 17-18, paragraphs 54.

C selects only the coordinate points identified as members of the region. The resulting winPoly will contain only image data for the selected region. FIG. 8 shows a screen shot of the graphical interface 40 following the scalpelling operation. As shown in the sectional views 44, 46 and 48, the scalpelling has removed all image data in the unselected area 62 surrounding the selected region of interest 60. The visible faces of the rectangular volume in the volume view 42 show no image because the region selected did not capture any coordinate points within the visible planes, i.e. the outer edges of the image space.[18]

The volume view 42 may then be rendered to show the rendered image 64 of the selected region of interest 60, as depicted in the screen shot shown in FIG. 9. The user may then use all the existing features of the system 22 to rotate, scale or translate the rendered image 64 of the fetus' face, as shown in FIG. 10. A printing device may be attached to the computer system to print the rendered volume view 42.[19]

In a further embodiment, the selected region is rendered in the volume view 42 at each iteration, allowing the user to monitor the growth of the region in that view as well. See FIGS. 11 through 17 which show a screen shot of the graphical interface 40 illustrating an embodiment of the

[18] See page 18, paragraph 55.
[19] See page 18, paragraph 56.

invention wherein the selected region is rendered in the volume view 42 during the region growing process.[20]

VI. GROUNDS OF REJECTION TO BE REVIEW ON APPEAL:

Appellants seek the Board's review of the rejection of claims 30-35 under 35 U.S.C. § 112, second paragraph; the rejection of claims 1, 2, 4-6, 15, 18, 20, 21 and 27-35 under 35 U.S.C. § 102b as being anticipated by Hartley; and the rejection of claims 14 and 26 under 35 U.S.C. § 103 as being unpatentable over Hartley.

VII. ARGUMENTS:

A. Appellants traverse the rejection of claims 30-35 under 35 U.S.C. § 112, second paragraph

The Examiner states claims 30-35 lack antecedent basis with respect to the phrase "into adjacent voxels." Claims 30 and 33 include this terminology. Claims 30 and 33 do not recite "into <u>said</u> adjacent voxels" or "into <u>the</u> adjacent voxels." Instead, the "adjacent voxels" are originally introduced in a proper fashion by the phrase "into adjacent voxels."

Appellants respectfully request the Board to reverse this rejection.

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20 See page 19, paragraph 47.

A. Appellants traverse the rejection of claims 1, 2, 4-6, 15, 18, 20, 21 and 27-35 under 35 U.S.C. § 102b as being anticipated by a paper by Hartley; and the rejection of claims 14 and 26 under 35 U.S.C. § 103 as being unpatentable over Hartley.

Claims 1, 4-6, 14-15, 18, 20, 21, 26, 28-29, and 31-35 rise and fall together.

Claims 2, 27 and 30 rise and fall together.

i) Claims 1, 4-6, 14-15, 18, 20, 21, 26, 28-29, and 31-35

Hartley teaches a cardiac segmentation system. The system acquires a series of images as slices through a volume. The images are typically taken at different time periods throughout the cardiac cycle. To segment the data in order to isolate certain structures, such as blood volume in the left ventricle, the system performs region growing about a seed point. The process begins with the user defining a region of interest in one of the two-dimensional images. See col. 4, lines 26-30, and also see col. 3, line 3, which defines "image" as a single slice and phase (i.e., a two-dimensional image). The user may define a rectangle or other polygon within the image that includes the desired feature such as the left ventricle. The user then selects an initial seed point within the region of interest that they have defined. The system performs two-dimensional region growing around the initial seed point based upon an initial threshold. The user may interactively adjust the initial threshold setting (see col. 4, line 13). Once

the user is satisfied with the threshold setting and the resulting segmented region displayed within the user defined region of interest in the two-dimensional image, the system automatically performs the segmentation operation on each image in the series of images.

The automated segmentation performed by the system of Hartley involves calculating a threshold update based upon an analysis of a histogram calculation using the segmented region and a set of pixels just outside the segmented region. See col. 4, lines 32-64. In particular, at column 5, lines 10-15, Hartley specifies that an adjusted threshold is used as the threshold by the masking device on the adjacent image, and the last processed image is used to determine a centroid and region of interest. The centroid of the current image is used as a seed point for the next adjacent image. This section of Hartley makes clear that a new seed point is selected in each image. Moreover, an adjusted threshold is established specific to each image.

Accordingly, the system of Hartley steps through a set of image slices and determines a two-dimensional (2D) segmented region in each image using threshold based region growing. Column 5, lines 15-23 also state that the 2D segmentation outline for each slice for a given phase may be used to construct a 3D surface. Namely, Hartley teaches two-dimensional region growth around a specific seed point in each image and the stitching together of the two-dimensional regions to obtain a three-

dimensional volume. In this sense, the Hartley system cannot be said to be "growing a region in three-dimensions about said seed point" as recited in claim 1. In Hartley, the growing does not occur in three-dimensions and the three-dimensional growth is not about said seed point.

The system and method of Hartley are aimed at solving the problem of using a fixed seed point and threshold for images in a cardiac scan, where a series of images are taken at different periods throughout the cardiac cycle. The differences from slice to slice may be relatively small, but the differences over the whole series of images can be significant and result in poor segmentation. Hartley teaches that the threshold-based growing region, which is performed in two dimensions within each image slice independently, should be adjusted for each slice based upon the segmented region arrived at in the previous slice. Accordingly, Hartley updates the seed point and threshold before growing a region in each two dimensional image.

By contrast, the independent claims of the subject application, for example claim 1, recite "determining a seed point in the volume defining array in response to the selection by the user of a pixel in the view of the volume being displayed." Further in contrast to Hartley, the independent claims recite such as in claim 1, "growing a region in three dimensions about the seed point."

Independent claims 18 and 28 include similar limitations to those discussed above with respect to claim 1, and therefore, at patentable at least for the reasons stated above with respect to claim 1.

As demonstrated above, Hartley neither discloses nor suggests the subject matter recited in the independent claims, and therefore, for at least these reasons, cannot anticipate or render claims 1, 4-6, 14-15, 18, 20, 21, 26, 28-29, and 31-35 obvious to one skilled in the art.

Appellants respectfully request that the Board reverse this art grounds of rejection.

i) Claims 2, 27 and 30

As discussed above, Hartley discloses that a user may adjust the initial threshold used in growing the two-dimensional region around the initial seed point. As discussed in Col. 4, lines 12-13, a user may manipulate a slide bar to adjust the initial threshold. However, once the initial threshold is established, it is automatically updated for subsequent images.

Claim 2 recites several steps for growing the region in three-dimensions, and that "the number of iterations performed is responsive to the user interface." The user selected initial threshold of Hartley merely provide a discriminatory value for growing an initial two-dimensional region, and impacts the threshold used for growing subsequent

two-dimensional regions. However, the initial threshold does not control the number of iterations for growing a region, and more particularly, does not control the number of iterations of the steps recited in claim 2 for growing a three-dimensional region.

Claims 27 and 30 include similar limitations to those discussed above with respect to claim 2, and therefore, at patentable at least for the reasons stated above with respect to claim 2.

As demonstrated above, Hartley neither discloses nor suggests the subject matter recited in claims 2, 27 and 30, and therefore, for at least these reasons, cannot anticipate or render claims 2, 27 and 30 obvious to one skilled in the art.

Appellants respectfully request that the Board reverse this art grounds of rejection.

VIII. CONCLUSION:

Appellants respectfully request the Board to reverse the Examiner's rejections.

Pursuant to 37 C.F.R. 1.17 and 1.136(a), the Appellants respectfully petition for a one extension of time for filing a response in connection with the present application, and the required fee of $110 is attached.

The Commissioner is authorized in this, concurrent, and future replies, to charge payment or credit any overpayment to Deposit Account No. 08-0750 for any additional fees required under 37 C.F.R. § 1.16 or under 37 C.F.R. § 1.17; particularly, extension of time fees.

Respectfully submitted,

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Attachment: IX. Claims Appendix
X. Evidence Appendix
XI. Related Proceedings Appendix

CLAIMS APPENDIX

Claims 1-2, 4-8, 10-12, 14-15, 18, 20-24 and 26-35 on Appeal:

1. A method of selecting a portion of a 3D volume, the portion of the volume containing a feature of interest, a view of the volume being displayed on a display, the view being generated from a volume-defining array containing data corresponding to properties at points within a coordinate system containing the volume, the volume-defining array being stored by an image processing system, and a user having a user interface for interacting with the image processing system, the method comprising the steps of:

a) determining a seed point in the volume defining array in response to the selection by the user of a pixel in the view of the volume being displayed; and

b) growing a region in three-dimensions about said seed point, wherein the growth of said region is responsive to input from the user interface, such that manipulation of the user interface selectively determines the extent of the growth of said region.

2. The method defined in claim 1, wherein said step of growing said region comprises an iterative series of steps, the steps comprising:

evaluating an untested point in the volume defining array adjacent to a boundary member point to determine if the untested point is a member of said region, said boundary member point being said seed point for a first iteration and said boundary member point being a member point at the boundary of said region for subsequent iterations;

adding to said region the untested points that are determined to be members of said region;

excluding from said region the untested points that are determined not to be members of said region; and

visually distinguishing, on the view of the volume being displayed, the points determined to be members of said region from other points,

wherein the number of iterations performed is responsive to the user interface, such that manipulation of the user interface selectively determines the extent of the growth of said region.

4. The method defined in claim 1, wherein said_view of the volume being displayed comprises a sectional view of said 3D volume and the method further comprising the step, prior to step (a), of displaying said sectional view in response to user selection of a sectional plane through said 3D volume.

5. The method defined in claim 4, wherein said sectional view includes a

portion of said feature of interest, and wherein said pixel selected by the user for determining a seed point comprises a pixel located within the feature of interest.

6. The method defined in claim 2, wherein said step of visually distinguishing comprises blacking out the pixels in said view corresponding to points in the volume defining array determined to be member points of said region.

7. The method defined in claim 6, wherein manipulation of the user interface causes a decrease in said number of iterations performed, and wherein in response thereto said region is retracted and said blacking out is removed from pixels corresponding to former member points of said region.

8. The method defined in claim 7, wherein said blacking out comprises the application of a mask to said volume defining array, said mask comprising a three dimensional array, the entries of said mask indicating the member status of each point in the volume defining array.

10. The method defined in claim 1, wherein the user interface has an initial position, and wherein subsequent thereto the user interface may be

displaced from said initial position, said displacement causing the extent of the region to be expanded.

11. The method defined in claim 10, wherein retraction of the user interface towards said initial position causes the extent of the region to be retracted.

12. The method defined in claim 10, wherein said user interface comprises a computer mouse.

14. The method defined in claim 1, wherein said data is ultrasound data.

15. The method defined in claim 1, wherein said user interface comprises a device selected from the group comprising a keyboard, a mouse, a trackball, a touch pad, a microphone and a pen.

18. An image processing system for selecting a portion of a 3D volume, the portion of the volume containing a feature of interest, a view of the volume being displayed on a display, the view being generated from a volume-defining array containing data corresponding to properties at points within a coordinate system containing the volume, the volume-defining array being stored by the image processing system, a seed point in the

volume defining array being determined based upon the selection by a user of a pixel in the view of the volume being displayed, the image processing system comprising:

(a) a user interface for selecting said pixel and for selectively determining the extent of the growth of a region; and

(b) region growing module for growing said region in three-dimensions about the seed point, said region growing module increasing and decreasing the growth of said region performed in response to manipulation of said user interface;

wherein the view of the volume being displayed shows the size of said region.

20. The image processing system as defined in claim 18, wherein said view of the volume being displayed on the display comprises a sectional view of said 3D volume, the system further including a view selection module, said view selection module being responsive to user selection of a sectional plane through said three dimensional volume.

21. The image processing system as defined in claim 20, wherein said region growing module further includes a mask component for blacking out pixels in said sectional view corresponding to the points in the volume

defining array determined to be members points of said region.

22. The image processing system defined in claim 18, wherein said user interface has an initial position and wherein displacement of said user interface from said initial position causes the extent of growth performed by said region growing module to be increased.

23. The image processing system defined in claim 22, wherein the extent of growth performed is decreased in response to retraction of said user interface towards said initial position.

24. The image processing system defined in claim 23, wherein said user interface comprises a computer mouse.

26. The image processing system defined in claim 18, wherein said data is ultrasound data.

27. The image processing system defined in claim 18, wherein said region growing module performs an iterative series of steps, each iteration expanding the growth of said region, and wherein the number of iterations performed is responsive to the user interface, such that manipulation of the user interface selectively determines the extent of the growth of said region

28. A computer program product comprising a computer readable medium carrying program means for selecting a portion of a volume, the portion of the volume containing a feature of interest, a view of the volume being displayed on a display, the view being generated from a volume-defining array containing data corresponding to properties at points within a coordinate system containing the volume, the volume-defining array being stored by an image processing system, and a user having a user interface for interaction with the image processing system, the computer program product comprising:

code means for determining a seed point in the volume defining array in response to the selection by the user of a pixel in the view of the volume being displayed; and

code means for growing a region about said seed point, wherein the growth of said region is responsive to the user interface, such that manipulation of the user interface selectively determines the extent of the growth of said region.

29. The computer program product defined in claim 28 wherein the computer readable medium comprises a medium selected from the group comprising a modulated electrical signal, a modulated optical signal, a magnetic storage medium and an optical storage medium.

30. The method defined in claim 1, wherein said step of growing said region included iteratively growing said region into adjacent voxels meeting member criteria, and wherein a number of iterations is selectively adjusted by the user through the user interface.

31. The method defined in claim 30, further including a step of displaying, at each iteration, the extent of the growth of said region.

32. The method defined in claim 31, wherein the view of the volume being displayed includes at least one sectional view of the volume and said step of displaying includes displaying the extent of the growth of said region within said sectional view.

33. The image processing system claimed in claim 18, wherein said region growing module iteratively grows said region into adjacent voxels meeting member criteria, and wherein said user interface selectively adjusts a number of iterations performed by said region growing module.

34. The image processing system claimed in claim 33, further including a display module for displaying, at each iteration, the extent of the growth of said region.

35. The image processing system claimed in claim 34, wherein the view of the volume being displayed includes at least one sectional view of the volume and said display module displays the extent of the growth of said region within said sectional view.

X. EVIDENCE APPENDIX

No evidence has been submitted pursuant to §§ 1.130, 1.131, or 1.132 of this title, nor has any other evidence been entered by the examiner and relied upon by appellant in the appeal. As such, Appellants have omitted the Evidence appendix under 37 C.F.R. § 41.37(c)(1)(ix).

XI. RELATED PROCEEDINGS APPENDIX

Presently, there are no related proceedings pursuant to 37 C.F.R. § 41.37(c)(1)(ii).